Infectious Diseases

Infectious diseases are human illnesses caused by viruses, bacteria, parasites, fungi, and other microbes. They can be spread by direct contact with an infected person or animal, through ingestion of contaminated food or water, by insects like mosquitoes or ticks (disease vectors), or by contact with contaminated surroundings such as through touching animal droppings or breathing in contaminated air. Demographic and environmental factors such as population growth, increased urbanization, and alteration of habitats of disease-carrying insects and animals (e.g., irrigation, deforestation) may promote the spread of infectious diseases (CDC, 1998a). The three broad infectious disease categories included here are those whose appearance and spread may be influenced to some extent by environmental conditions and change. They include gastrointestinal (GI) diseases, arthropod-borne diseases, and legionellosis.

- **Gastrointestinal diseases.** Eight notifiable GI diseases caused by microorganisms are discussed below: cholera, cryptosporidiosis, shiga toxin-producing *Escherichia coli (E. coli)* (STEC), giardiasis, hepatitis A, salmonellosis, shigellosis, and typhoid fever. The major environmental source of gastrointestinal illness is water or food that is contaminated with pathogenic microorganisms. The primary means of transmission for these eight diseases is through ingestion of contaminated food/water or through contact with and accidental ingestion of fecal matter (CDC, 2015a).

- **Arthropod-borne diseases.** Three arthropod-borne diseases are included: Lyme disease (transmission of *Borrelia burgdorferi* by ticks), Rocky Mountain spotted fever (transmission of *Rickettsia rickettsii* by ticks), and West Nile virus (transmitted by mosquitoes). Certain ticks and mosquitoes (arthropods) can carry bacteria and viruses that cause disease in humans. The arthropods acquire the bacteria or viruses when they bite an infected mammal or bird. Some studies indicate that spread of vector-borne disease may be influenced by land use and/or other environmental change (CDC, 2004). In recent years, both Lyme disease and West Nile virus have spread across the U.S. (CDC, 1993, 2000, 2004). Surveillance for Lyme disease was initiated by the Centers for Disease Control and Prevention (CDC) in 1982 (CDC, 1993).

- **Legionellosis.** Legionellosis, or Legionnaires' disease, is a serious and sometimes fatal form of pneumonia. It is caused by *Legionella* bacteria, which are found naturally in the environment and thrive in warm water and warm damp places. They are commonly found in lakes, rivers, creeks, hot springs, and other bodies of water. This bacterium has been associated with outbreaks in the U.S. linked to poorly maintained artificial water systems (e.g., air conditioning and industrial cooling systems) and air ventilation systems. Infection results from inhalation of contaminated water sprays or mists (CDC, 2016).

This indicator reflects occurrence of these notifiable diseases as reported by health departments to the National Notifiable Diseases Surveillance System (NNDSS). A notifiable disease is one for which regular, frequent, and timely information regarding individual cases is considered necessary for the prevention and control of the disease (CDC, 2005). Data are collected by all 50 states, five territories, New York City, and the District of Columbia, based on a list of recommended nationally notifiable infectious diseases, and compiled nationally (CDC, 2015b). The temporal coverage of the data varies by disease. The number of states reporting may also vary. For example, in 1995, when cryptosporidiosis was first nationally reported, only 27 states reported; 45 states reported this disease by 1997.

What the Data Show

Gastrointestinal Diseases

Exhibit 1 presents the number of reported cases for each of the eight notifiable GI diseases from 1995-2013.

Cholera. In comparison to the other GI diseases, the number of newly identified cholera cases reported each year is low. From 1995 to 2013, just 196 laboratory-confirmed cases of cholera were reported to CDC, with the highest number of cases during this period (i.e., 40) being reported in 2011.

Typhoid Fever. The number of newly identified cases of typhoid fever fluctuated from 1995 to 2013, ranging between a low of 321 cases in 2002 and a high of 467 cases in 2010.

Hepatitis A continued to decline from 1995 (31,582 cases) to 2011 (1,398 cases), but then slightly increased in 2012 (1,562 cases) and 2013 (1,781 cases).

Cryptosporidiosis. The increasing trend of reported cryptosporidiosis cases beginning in 2005 (5,659) peaked in 2007 (11,170). Since then there have been decreased and increased reporting of cases from 2008 to 2013, with a range of 7,654 cases reported in 2009 and 9,250 cases reported in 2011; these more recent numbers are well above the number of cases reported between 1995 and 2004. It remains unclear whether the greater number of case reports between 2005 and 2013 reflects changes in reporting patterns and diagnostic testing practices or a real change in infection transmission. For example, the increase in 2005 (and possibly 2007) was attributable primarily to outbreak-related case reporting. However, increased testing for Cryptosporidium following the introduction of nitazoxanide (2002-2004), the first licensed treatment for the disease, also may have led to a possible increase in subsequent case reporting (CDC, 2008).

Shigellosis. The lowest number of shigellosis cases observed during the 1995 to 2013 time period occurred in 2013 with 12,729 cases reported, a decrease from 2012 with 15,283 cases reported.

Giardiasis. The number of cases observed for giardiasis remained relatively steady from 2002 to 2010, and then continually decreased until 2013 (15,106 cases).

Salmonellosis. The highest number of salmonellosis cases during the reporting period was in 2010 (54,424), with numbers remaining above 50,000 cases in 2011 (51,887), 2012 (53,800), and 2013 (50,634).

STEC. The number of reported cases of *E. coli* (presented in Exhibit 1 as Shiga toxin-producing E. coli, or STEC) fluctuated from 1995 to 2007, dropped in 2009 (4,643) compared to those reported in 2008 (5,309), and then increased each year up to 6,663 cases in 2013—the highest number of cases during the reporting period.

Arthropod-Borne Diseases

Exhibit 2 presents the number of reported cases for three arthropod-borne diseases.

Lyme disease is the most commonly reported arthropod-borne disease in the U.S., with the most cases (38,468) during the period reported in 2009, a 9 percent increase from 2008 (35,198 cases) and nearly double the number reported in 2006 (19,931 cases). A 22 percent decrease occurred from 2009 to 2010 (30,158 cases), followed by a 10 percent increase to 33,097 cases in 2011, a seven percent decrease to 30,831 cases in 2012, and then an 18 percent increase to 36,307 cases in 2013.

Rocky Mountain spotted fever. CDC began surveillance of Rocky Mountain spotted fever in 1970. The number of new cases of Rocky Mountain spotted fever reported from 1995 to 2008 has generally been increasing, ranging between a low of 365 cases in 1998 and a high of 2,563 cases in 2008. In 2009 and 2010, however, a decrease was observed with 1,815 cases and 1,985 cases reported, respectively; but this increased in 2011 to 2,802 cases and in 2012 to 4,470 cases, when the highest number of cases during the reporting period was observed. A decrease was then observed in 2013, with 3,359 cases reported.

West Nile virus. Cases of West Nile virus were first documented in the U.S. in 1999. West Nile virus became nationally reportable in 2002, and the number of reported cases rose from 2,840 in 2002 to 2,866 in 2003. Between 2004 and 2007 the number of reported cases remained relatively stable, ranging from 1,142 reported cases in 2004 to 1,495 reported cases in 2006. The lowest number of cases reported during the 2002 to 2013 time period occurred in 2009 (386 cases), representing a continued notable decrease from 2007 (1,227 cases) and 2008 (689 cases). However, the number of reported cases increased from 2009 to 2010 (629 cases), followed by another decrease in 2011 (486 cases). In 2012, the largest number of cases over the entire reporting period occurred, with 2,872 cases reported, before decreasing to 1,267 cases in 2013.

Legionellosis

Exhibit 3 presents the number of reported cases of legionellosis within the U.S. population from 1995 to 2013. From 1995 to 2002, the number of new cases of legionellosis was relatively stable, ranging from a low of 1,108 cases in 1999 to 1,355 cases in 1998. However, generally an increase in the number of new cases was reported since 2003 (2,232 cases), with the highest number reported in 2013 (4,954 cases).

Limitations

- State health departments report cases of notifiable diseases to CDC; reporting policies (and compliance with those policies) can vary by disease or reporting jurisdiction.
- Disease reporting likely underestimates the actual number of cases for a given time period because reporting nationally notifiable diseases to CDC is voluntary. Additionally, the completeness of reporting likely varies by disease. The degree of completeness of data reporting is influenced by many factors such as the diagnostic facilities available, the control measures in effect, public awareness of a specific disease, and the interests, resources, and priorities of state and local officials responsible for disease control and public health surveillance (CDC, 2015b).
- Factors such as changes in case definitions for public health surveillance, introduction of new diagnostic tests, or discovery of new disease entities can cause changes in disease reporting that are independent of the true incidence of disease (CDC, 2015b).
- Prior to 2001, shiga toxin-producing Escherichia coli (STEC) represents E. coli O157:H7, which was the only serotype that was nationally notifiable. From 2001-2005, STEC represents the sum of the three nationally notifiable shiga toxin-positive E. coli forms (O157:H7, non-O157, and not serogrouped). As of 2006, serogrouped E. coli cases are no longer nationally notifiable; STEC represents the notifiable form. These differences in reporting should be considered when making cross-year comparisons.
- Prior to 2005, only confirmed "neuroinvasive" cases of West Nile virus—the most severe form of the condition—were reported. Beginning in 2005, non-neuroinvasive domestic arboviral diseases for the six domestic arboviruses listed were added to the list of nationally notifiable diseases; these included West Nile fever, a non-neuroinvasive form of West Nile virus (CDC, 2015b). In order to maintain reporting consistency, only neuroinvasive cases are

presented for this indicator.

Data Sources

The data for this indicator were obtained from CDC annual reports that summarize data on nationally notifiable infectious diseases reported to CDC by state health agencies across the country (CDC, 1996, 1997, 1998b, 1999, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015b). Data are collected and compiled from reports sent by state health departments to the NNDSS, which is operated by CDC. The NNDSS is neither a single surveillance system nor a method of reporting. Certain NNDSS data are reported to CDC through separate surveillance information systems and through different reporting mechanisms; however, these data are aggregated and compiled for publication purposes (CDC, 2011).

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CDC. 2005. Summary of notifiable diseases—United States, 2003. MMWR 52(54). See Table 1. http://www.cdc.gov/mmwr/PDF/wk/mm5254.pdf (PDF) (88 pp, 1.3MB).

CDC. 2004. Summary of notifiable diseases—United States, 2002. MMWR 51(53). See Table 1. http://www.cdc.gov/mmwr/PDF/wk/mm5153.pdf (PDF) (88 pp, 2.2MB).

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CDC. 2002. Summary of notifiable diseases—United States, 2000. MMWR 49(53). See Table 1. http://www.cdc.gov/mmwr/PDF/wk/mm4953.pdf (PDF) (128 pp, 6.5MB).

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CDC. 1997. Summary of notifiable diseases—United States, 1996. MMWR 45(53). http://www.cdc.gov/mmwr/PDF/wk/mm4553.pdf (PDF) (103 pp, 1MB).

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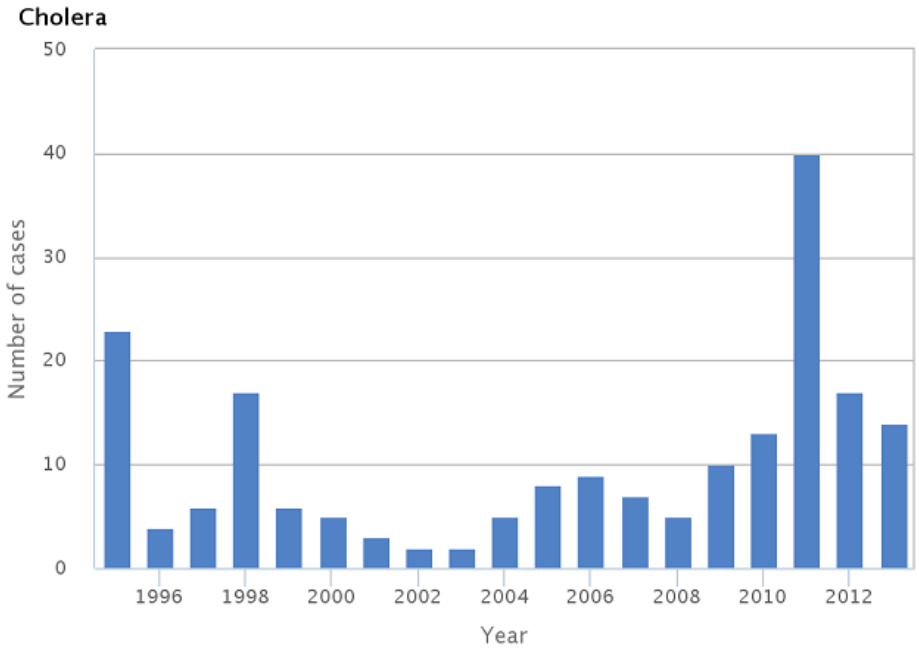
Exhibit 1. Number of reported cases of gastrointestinal diseases in the U.S., 1995–2013

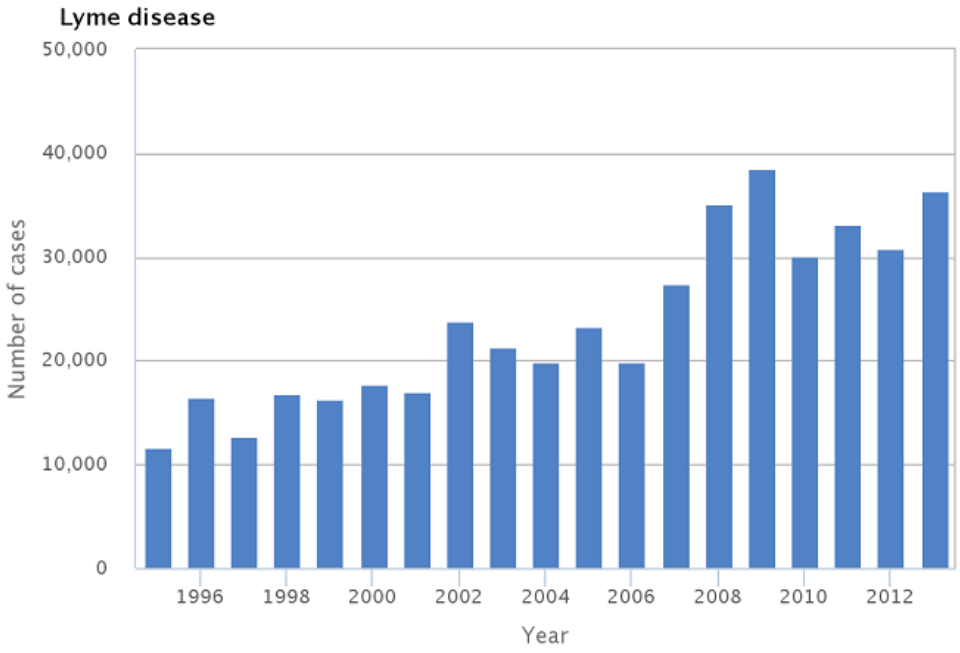


Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: CDC, 1996, 1997, 1998b, 1999, 2001, 2002, 2003b, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015b

Visit http://www.epa.gov/roe to see the full exhibit.

Exhibit 2. Number of reported cases of arthropod-borne diseases in the U.S., 1995-2013

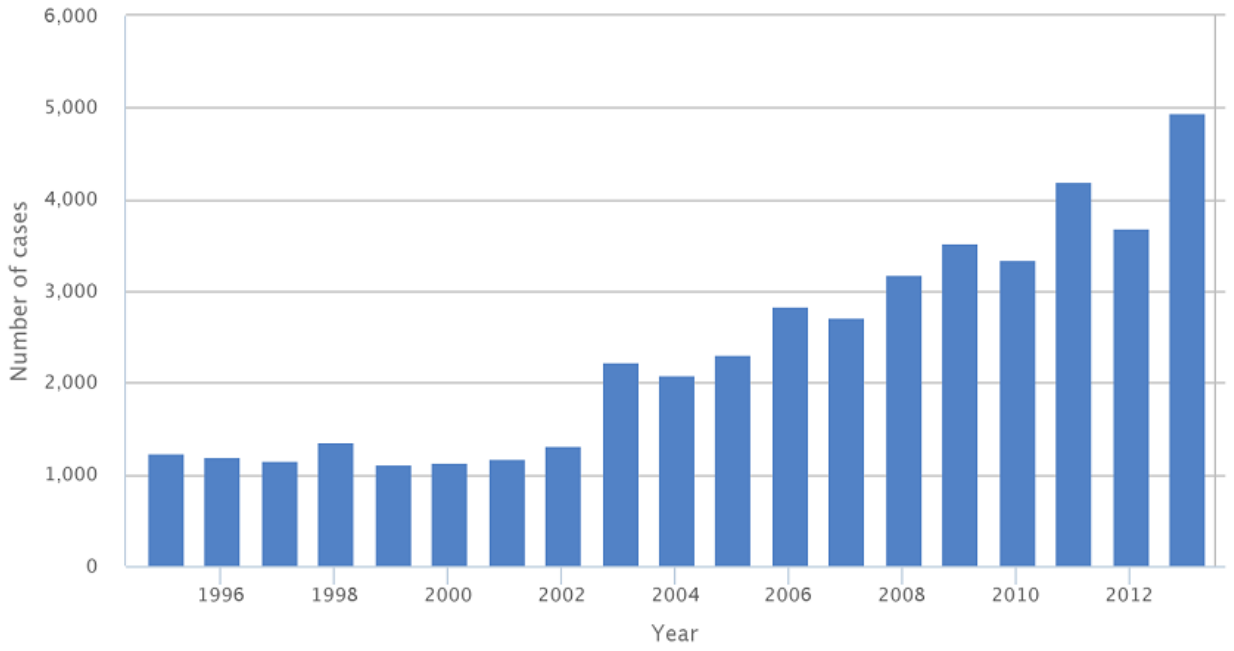


Information on the statistical significance of the trend in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: CDC, 1996, 1997, 1998b, 1999, 2001, 2002, 2003b, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015b

Visit http://www.epa.gov/roe to see the full exhibit.

Exhibit 3. Number of reported cases of legionellosis in the U.S., 1995–2013



Information on the statistical significance of the trends in this exhibit is not currently available. For more information about uncertainty, variability, and statistical analysis, view the technical documentation for this indicator.

Data source: CDC, 1996, 1997, 1998b, 1999, 2001, 2002, 2003b, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015b